9.0 Case Study Applications to Urban Areas

The methods of this manual are primarily intended to provide the freight portion of a regionwide forecast of vehicular travel. Three case studies are presented here: Lawrence, Kansas; Appleton-Neenah (Fox Cities), Wisconsin; and Green Bay, Wisconsin. The Lawrence application has the fewest and roughest steps, so it is presented first. The forecasts in Green Bay and Appleton-Neenah (Fox Cities) have much in common, so they are described together with an emphasis on Appleton-Neenah (Fox Cities). In addition, a site impact analysis is presented for a moderate-sized industrial facility in Green Bay.

Of greatest interest here are data preparation as well as the process of applying quick response methods to produce base-year forecasts.

■ 9.1 Lawrence, Kansas

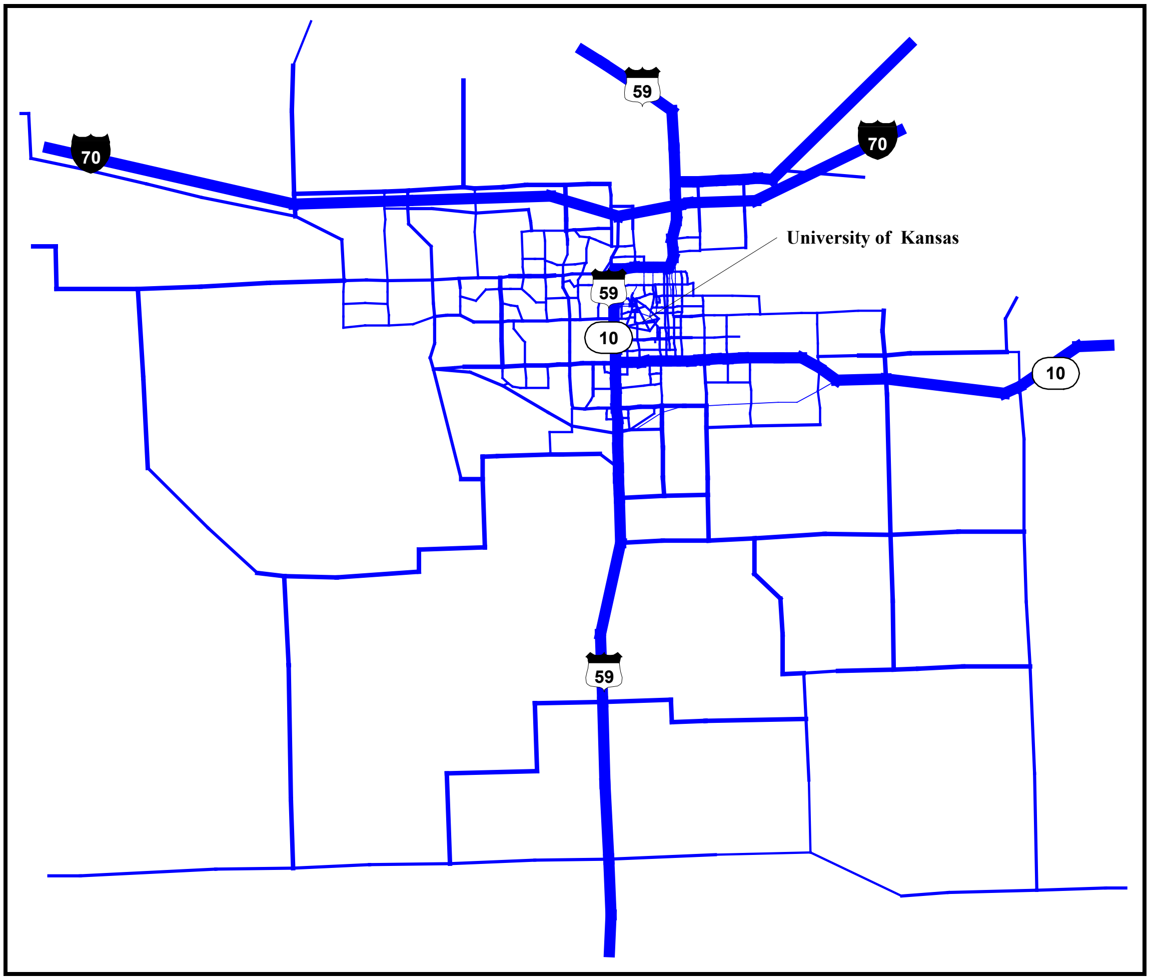
9.1.1 Background on Lawrence

Lawrence is a peaceful city with a stormy history. In the 1850's to 1860, Lawrence and its surrounding areas were sites of violence related to whether Kansas would be a free State or a slave State. The City of Lawrence was founded in 1854 by the New England Emigrant Aid Company in Boston and was planned to be the capital of Kansas.

Lawrence soon became the center of Free State activities and a haven for runaway slaves. During the Civil War, Lawrence was also the site of an attack by Confederate guerrillas, which resulted in the city being sacked and burned. After this incident, Lawrence rebuilt itself and in 1866 became the site of the first state university in the Great Plains. However, Lawrence's growth was later overshadowed by neighboring Kansas City and Wichita.

Lawrence is situated in the eastern portion of Kansas, 40 miles west of Kansas City Kansas/Missouri and 30 miles east of Topeka (see Figure 8.2). The population of the Lawrence SMSA was estimated to be approximately 80,000 in 1995, with the City of Lawrence having approximately 70,000 persons. The most prominent feature of Lawrence is the University of Kansas. However, the city should not be entirely classified as a college town. Some of the major employers include Hallmark Cards, Sallie Mae Loan Servicing Center, a K-Mart distribution center, Allied Signal, and Davol Incorporated, makers of medical and laboratory equipment. These major employers serve as examples of the diversified economy of Lawrence.

Figure 9.1 Street System in Lawrence Highlighting Major Through Routes



9.1.2 Lawrence Freight Transportation Model

Lawrence Kansas Street System and Land Use Patterns. The Lawrence street network has three major traffic arterials: Interstate 70 (part of the Kansas Tollway system); US 59 and Route 10 (see Figure 9.1 above). Interstate 70 is the key link between the Kansas City, Lawrence and Topeka areas for regional trips and for points east and west. Route 10 is an alternative limited access facility to and from the southern side of Kansas City. However, this highway becomes a regular city street within the city limits of Lawrence. As a result, a significant amount of through traffic flows through the City of Lawrence. US 59 is a major north-south facility for interurban trips as well as being a significant intercity artery in eastern Kansas. These arterials carry the bulk of the traffic in the urbanized area. This is particularly true for truck traffic, as will be seen later.

Land use in Lawrence is fairly compact. The major employers are located in the city center and in some industrial parks near Interstate 70 or near the northern part of the city. While the University of Kansas is a dominant land use and one of the highest employers in the area, there is also a diverse group of industries, services and commercial establishments that are well represented. The major employers are identified in the next section in reference to special generators.

Description of Base Network. Lawrence already had a passenger vehicle forecasting model, which needed a freight component. The end product of a freight forecast would be a truck trip table, which can then be added to the automobile trip table prior to performing an equilibrium traffic assignment.

A considerable amount of data from the passenger model were applied to the freight component. The network structure was adopted in full, although the passenger data for zones were set aside for later processing, and external station data (derived from passenger vehicle counts) were discarded. Data for each TAZ included the number of retail employees, non-retail employees and dwelling units. The network links already contained speeds and capacities. None of the links were closed to truck traffic, thereby simplifying the traffic assignment step.

Recategorizing Employment. The original employment data from the passenger network were altered to reflect the trip generation categories recommended in this manual as follows:

- retail trade employment;
- manufacturing, transportation, communications, utilities and wholesale trade employment;
- office and service employment; and
- agriculture, mining and construction employment.

Although Lawrence had raw employment information for each employer that was identified by SIC code, a more efficient approach was adopted for recategorizing employment. Employment was already available for each traffic zone in two categories - retail and non-retail, consistent with the procedures presented in NCHRP Report 187[1]. These data needed to be reorganized into the four employment categories. Retail employment, of course, was already consistent. For each traffic analysis zone (TAZ) non-retail employment was split across the three remaining freight employment categories (manufacturing and wholesale, office, and other) according to the split of non-retail employment for the entire region. A detailed explanation of the procedure is presented later in this chapter.

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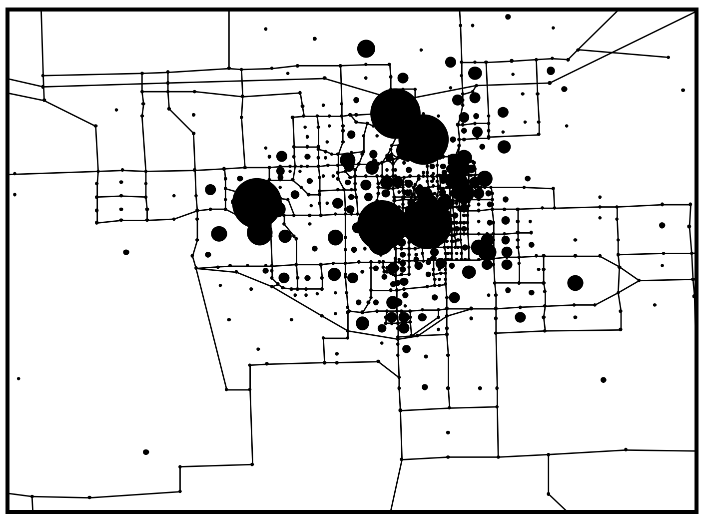
[1] Arthur B. Sosslau, et al., *Quick Response Urban Travel Estimation Techniques And Transferable Parameters, User's Guide*, National Cooperative Highway Research Program Report 187. National Research Council. Washington D.C. 1978.

Eleven special generators were identified namely: *Hallmark*, *University of Kansas*, *Lawrence Memorial Hospital*, *Sallie Mae Loan Servicing*, *Packer Plastics*, *K-Mart Distribution Center*; *University of Kansas Memorial Corp.*, *Davol Inc.*, *Allied Signal* (avionics electronics manufacturing), *E & E Specialties, Inc.* (point of purchase displays manufacturing) and *Lawrence Paper Company* (paper products). Their locations correspond to the areas of highest employment as shown in Figure 9.2 (centroid sizes are proportional to zonal employment). The employment splits for zones with special generators were adjusted accordingly, but the same default rates of Table 4.1 were used. The University of Kansas did not have much truck traffic, but it had a large employment that would distort the forecasts if no adjustments are made. The University of Kansas spanned approximately eleven zones.

Figure 9.2 Employment Concentrations in Central Lawrence



Truck Trip Generation. The forecasts included one trip purpose each for light trucks, medium trucks, and combination vehicles. Once the levels of employment were determined for each zone, total trip ends were estimated for each truck trip purpose according to the rates in Table 4.1.

A traditional travel forecasting model was used where trip generation results are provided as either productions or attractions (not origins and destinations). Different vehicle classes were handled somewhat differently in the conversion of trip ends to productions and attractions. For light and medium trucks, total trip ends were divided evenly between productions and attractions at all centroids. Because of the small size of Lawrence, combination vehicles were assumed not to make any internal-to-internal trips. To force the travel forecasting software to create only internal-to-external or external-to-internal trips for the combination vehicle "purpose", only trip productions were set at zonal centroids and only trip attractions were set at external stations.

External Stations. External stations were located in the perimeter of the region on several major arterials. The setting of external station data was greatly simplified by further assuming that only combination vehicles leave the region. Because combination truck trips at external stations were assumed to be only attractions, productions were set to zero for all trip purposes.

Attractions at external stations were taken directly from truck counts provided by KDOT or from estimates of truck volumes from the factors of Table 4.2 when counts were missing on some smaller roads. During the calculations, the software turns half of the attractions into origins and the other half of the attractions into destinations.

External-to-External Trip Table. The external-to-external trip table was developed by using the existing combination vehicle counts for the four major external stations that contained most of the external trips. These counts were divided in two to yield an equal amount of origins and destinations per external station. For trips originating from the external stations associated with Route 10 and Interstate 70, it was assumed that these trips would not double back in the Kansas City direction. In these cases, the trips were forced to the external station associated with US 59 (southern leg) or to that associated with the western leg of Interstate 70. This allocation resulted in the majority of the external trips associated with the external station along Interstate 70 staying on this facility.

Distribution and Network Assignment of Trips. The distribution of trips was determined with a gravity model using friction factors described in Section 4.4 of this manual. Lawrence did not have any data on truck trip lengths, so the friction factors could not be adjusted from the default values. Because of the assumption of no internal-to-internal trips for combination vehicles, the model was nearly insensitive to the friction factors for this purpose.

9.1.3 Calibration for Internal Consistency

The Lawrence freight model could only be made internally consistent, as there was no data on actual truck movements within the city. A Level 2 validation (see Section 7.5) can be performed at a later date.

Sampling of Calibration Links. Because only internal consistency could be checked, only a sample of links was deemed necessary. Thus, a sample of 100 links scattered throughout the network was selected. Care was taken to choose links of various functional classes so that the percentage of VMT by functional class on the sampled links was similar to the corresponding percentage on all links in the network. For each sampled link, the truck volumes were estimated using the factors of Table 4.2 applied to known counts of all vehicles.

Only four runs of the model were needed to implement the calibration procedure discussed in Section 4.5. Because passenger cars have been ignored, each run used "all-or-nothing" assignment.

Run 1 - Unadjusted. The freight model was run with the default parameters of Table 4.1. Production and attractions at external stations were set to replicate the full extent of link volumes entering and leaving the region, without using an E-E trip table. It was found that the model overestimated desired link volumes by 25 percent.

Run 2 - Productions and Attractions Reduced Based on Desired to Estimated Ratio. All productions and attractions at centroids were reduced by 25 percent while everything else (including external station data) remained constant. This resulted in approximately 9 percent overestimation by the model.

Run 3 - Introduction of External-to-External Trip Table. To create a more representative trip loading, the E-E trip table was added to the forecast and the attractions (no productions for combination vehicles) at external stations were reduced accordingly. Total productions no longer matched total attractions for combination vehicles, so the productions at centroids for combination vehicles were balanced to match attractions at external stations. This run did not change the number of truck trips on the network, but it did cause a significant redistribution of the trips across the network. The results were still approximately 5 percent greater than the desired link volumes.

Run 4 - Reduction of Production and Attractions. All productions and attractions at both centroids and external stations were reduced by five percent. The external-to-external trip table remained the same.

Given the paucity of data and the all-or-nothing assignment technique, further adjustments were unwarranted. After the fourth run the model was estimating total link volumes on the sampled links with overestimates of less than 1 percent.

Link-by-link analysis of the calibration results was considered inappropriate. The distribution of target truck traffic on the sample links was largely governed by the distribution of passenger car traffic in Lawrence. Substantial deviations at individual links were both expected and desirable. The outcome of the all-or-nothing assignment is illustrated in Figure 9.3. Link widths in the Figure are proportional to truck volumes, without removing streets with zero truck volumes.

This type of calibration exercise is performed only once for a base-year forecast to ascertain the final trip generation rates and to verify the strength of the external-to-external trip table. Forecasts for future years should not change the trip generation rates but could change the external-to-external trip table using growth factor methods.

9.1.4 Observations about Lawrence

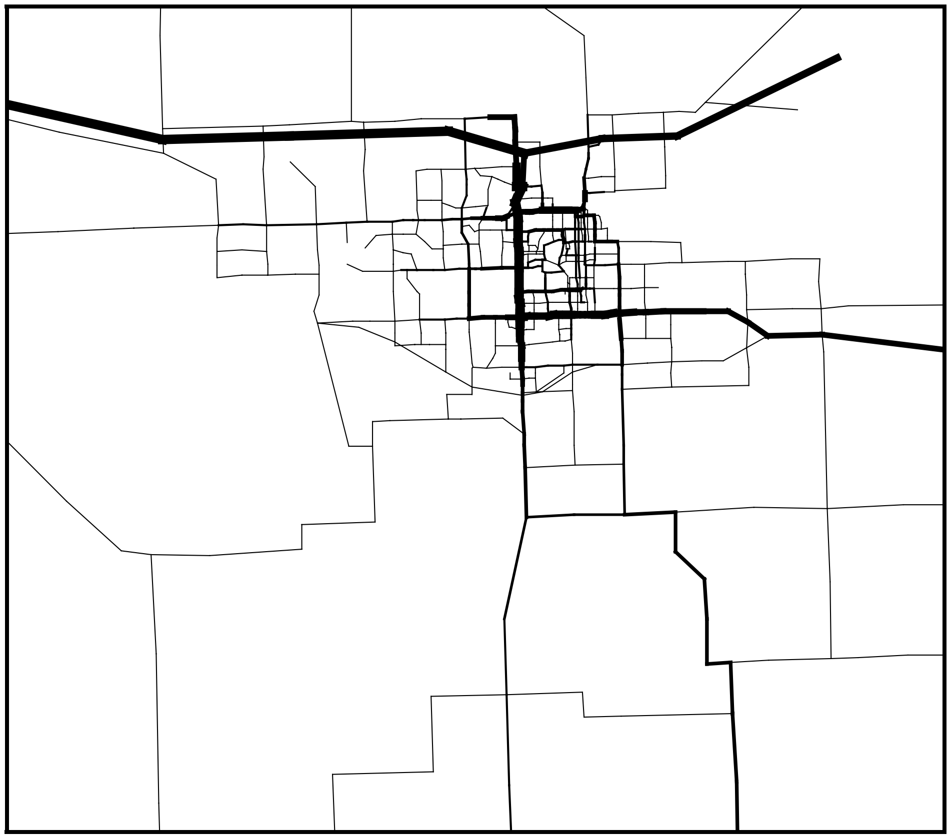
This exercise demonstrated that truck forecasting for an urban area using quick response methodologies is a relatively simple task, easily within the reach of most of the staff of State DOT's, MPO's and other planning agencies.

Some further recommendations to improve the accuracy of truck forecasting using methods in this manual are:

- Obtain actual ground counts of trucks by truck type on freeways and a good sample of major arterials;
- Survey key points along major facilities to obtain actual through truck movements;
- Further calibrate the statewide freight model so it can be more useful for estimating an external-to-external trip table; and
- Develop an employee database, which would identify employees by both SIC code and zone of employment.

The above recommendations will probably not significantly improve the calibration for Lawrence's immediate purposes, but they will improve the model's credibility when looking at truck-specific issues and policies.

Figure 9.3 All-or-Nothing Assigned Truck Volumes in Lawrence with the Widths of the Links Representing the Relative Truck Volumes.



■ 9.2 Fox Cities and Green Bay, Wisconsin

9.2.1 Introduction

Appleton-Neenah (Fox Cities) and Green Bay are two separate urbanized areas located in northeastern Wisconsin and are among the fastest growing urbanized areas in the State. These areas provide the fullest expression of Wisconsin's economy and aspirations, as they are the center of the paper and food processing industries, and are home to Wisconsin's professional football team -- the Green Bay Packers. Green Bay is the transportation hub of northeastern Wisconsin, with modern truck, rail, air, and seaport facilities. The Green Bay urbanized area recorded a population of 162,000 in 1990, making it the third largest urbanized area in Wisconsin. The Appleton-Neehan urbanized area had a 1990 population of 161,000. Since similar freight forecasting procedures were employed in both case studies, only Appleton will be discussed in full. However, the calibration process is briefly detailed for both case studies.

9.2.2 Fox Cities Case Study Background

The Appleton-Neenah urbanized area is commonly referred to as the Fox Cities. The Fox Cities are 14 communities along the Fox River: Appleton, Neenah, Menasha, Kaukauna, Kimberly, Combined Locks, and Little Chute and the Towns of Menasha, Vanderbroek, Buchanan, Harrison, Grand Chute, Greenville and Neenah. This region was discovered by French explorers in the 17th century. Louise Nicolet and Father Jacques Marquette are known to have traveled the length of the Fox River, en route to discovering the Mississippi River in 1673. The region was mostly settled by northern Europeans.

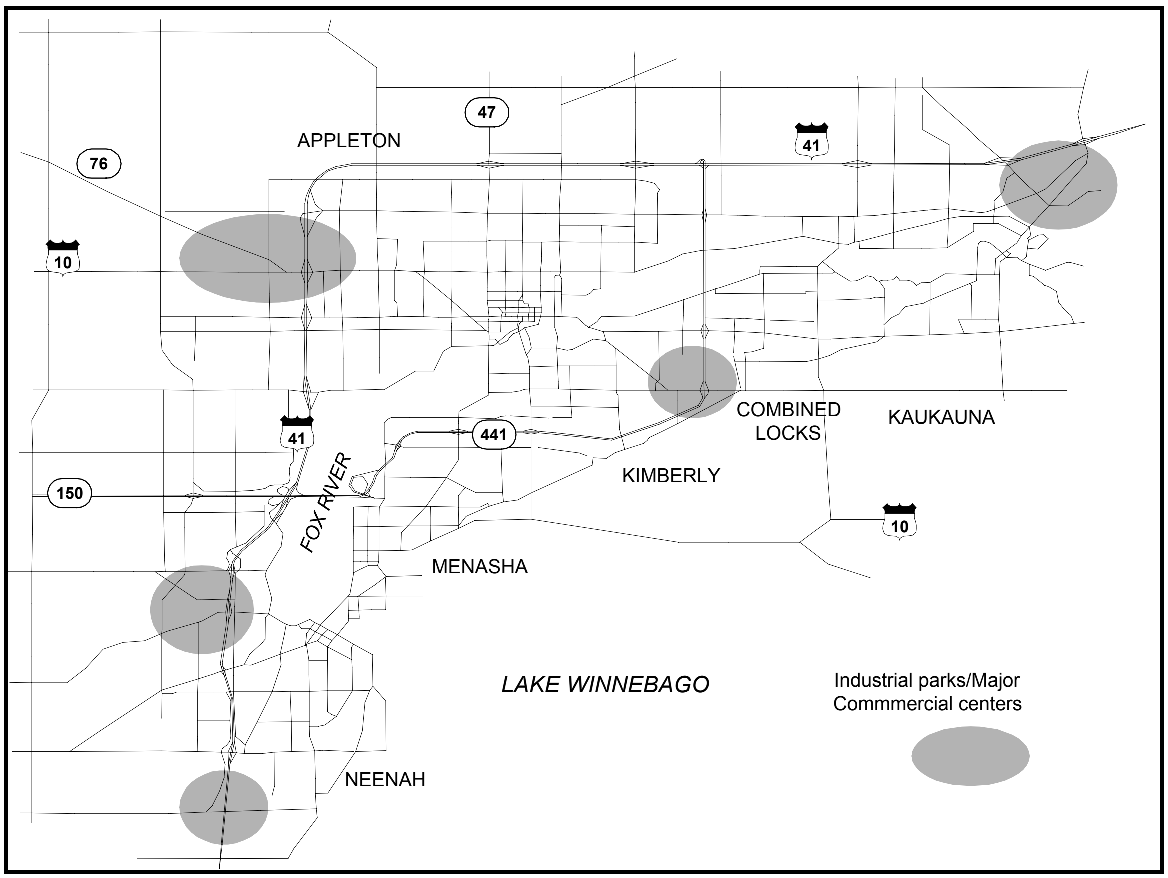
The city of Appleton is the largest of the Fox Cities. It is populated by a culturally diverse group of people. Besides those people of European ancestry, Hmongs, Hispanics, African Americans and Native Americans form significant portions of the population. The Oneida tribe represents the Native American population of Wisconsin. Their tribal heritage is preserved by the members residing in the Oneida Nation Reservation, a few miles north of Appleton. Their humane traditions and fascinating history give this region a unique blend the old and the new.

The Fox Cities, as well as Green Bay, are famous for their paper mills. The nickname "Paper Valley" is well earned as some of the nation's major paper companies are situated in the Fox River valley. *Kimberly-Clark*, *Wisconsin Tissue Mills*, *Menasha Corporation*, and *Appleton Papers* are located there. The economy of the Fox Cities is fairly diversified, but the paper industry retains its dominance over the economy. It continues to be the single largest employer in the Fox Cities. Therefore, it was not surprising to find that the "special generators" in Fox Cities mainly consisted of paper manufacturing firms.

9.2.3 Fox Cities Freight Transportation Model

As seen in Figure 9.4, US 41 traverses Fox Cities, serving as a main arterial. It carries most of the northbound and southbound traffic in the Fox Cities and beyond. A four-lane, limited access highway, US 41 provides access to the markets in Green Bay to the north, and Milwaukee and Chicago to the south. US 10 and US 45 are the other major highways serving the Fox Cities. Secondary roads include state truck highways 47, 55, 96, 110 and 114. Most of the large manufacturing firms are located along the Fox River close to US 41.

Figure 9.4 Fox Cities Urbanized Area and Major Highways



The Fox Cities, like Lawrence, already had a vehicle forecasting model[2], to which the freight component was to be added. The network structure was retained, along with the

[2] East Central Wisconsin Regional Planning Commission, *TM2, Fox Cities Urbanized Area Travel Demand Model Version 1.1*, Technical Memorandum, 1995.

speeds and the capacities on the links. All links were assumed to be able to carry truck traffic.

The employment data provided principally for passenger forecasting in the model were used to generate trip origins and destinations for freight modeling, following the procedures described in Section 7.7. The Fox Cities employment data were more detailed than the Lawrence employment data. Employment in each zone was broken down into commercial, manufacturing, services, wholesale/retail trade and others. Top employers, serving as special generators, were identified in the Fox Cities area. As mentioned earlier most of these were the paper and related products manufacturing firms, e.g., *Kimberly Clark*, *Appleton Papers*, *Outlook Graphics*, etc. High schools, malls, hospitals and similar facilities were excluded from the special generator category, as only establishments contributing a particularly large amount of truck traffic were considered.

For the Fox Cities case study, efforts were made to establish direct contacts with the management of some of the major special generators. The Fox Cities phone directory provided the addresses and the phone numbers of the 20 largest trucking firms within the area. Some of the questions asked pertaining to their trucking operations were: (a) How many of your trucks move in and out of the region; (b) Were these trucks light, medium or heavy; and (c) What was the regional extent of your trucking services? Since the firms were contacted over the phone, the questions were kept short and simple. The survey process itself was quite interesting, as it provided insights into the attitudes and policies of the firms with regard to information sharing.

Smaller firms, where the warehouse managers could be surveyed, were more forthcoming with their information. Their answers were informative, with some of them inquiring about the project and expressing their concerns regarding freight transport facilities in the region. On the other hand, larger firms were extremely restrictive with their information. Personnel departments, in particular, were unnecessarily concerned with liability issues, while parting with only the minimum amount of information. The discrepancies between the attitudes of the smaller and larger trucking firms posed great difficulties in data collection. The lesson of this exercise is that there should be a considerable amount of time allowed for even a small-scale primary data collection, during which written memoranda could be sent to the individual firms and follow-up phone calls can be made. A dialogue should be established, creating a favorable environment for gathering pertinent information.

As with the Lawrence network, truck trips at the external stations were assumed to be heavy-vehicle attractions and the productions were set to zero for all trip purposes. Fortunately, more actual truck counts were available in the Fox Cities for road segments leading to external stations. The attractions at the external stations were taken from the traffic counts provided by WisDOT, and in few cases where counts were unavailable, estimates of truck volumes as a fraction of total traffic were used (from Table 4.2). Thus, data at external stations in Fox Cities area could be set with a greater degree of confidence than in Lawrence.

The external-to-external truck trip table was provided by WisDOT for the base year. WisDOT developed its external-to-external trip table by surveying a sample of vehicles crossing cordon lines. There were 32 external stations, but only 113 of the 992 possible (non-diagonal) cells had observed truck trips. A part of the external-to-external trip table showing a few of the larger external stations (423, 400, 401, and 410) is given in Table 9.1. The availability of the external-to-external trip table greatly eased calibration and gave a higher degree of credibility to the model.

Table 9.1 Sample of External-to-External Truck Trips for the Fox Cities

Ex.Stat.	423	400	401	410
423	0	1448	110	17
400	877	0	0	64
401	57	0	0	291
410	0	301	61	0

9.2.4 Calibration to Ground Counts

Calibration was undertaken for links for which truck ADT counts were provided by WisDOT. These included the federal and state highways and some local principal arterials. Only three calibration runs were needed to achieve a suitable match between actual and average model link volumes:

Run 1 - Unadjusted. The initial run used default trip generation parameters from Table 4.1 and included the external-to-external trip table. The model overestimated link volumes by 19 percent.

Run 2 - Productions and Attractions Reduced Based on Desired to Estimated Ratio. All productions and attractions at the centroids were reduced by 19 percent, keeping everything else constant. The model overestimated the link volumes on the sampled links, by 3 percent.

Run 3 - Final Run. Again the productions and attractions were reduced. In the third run, the model overestimated the link volumes by less than 1 percent, and no further adjustments were undertaken.

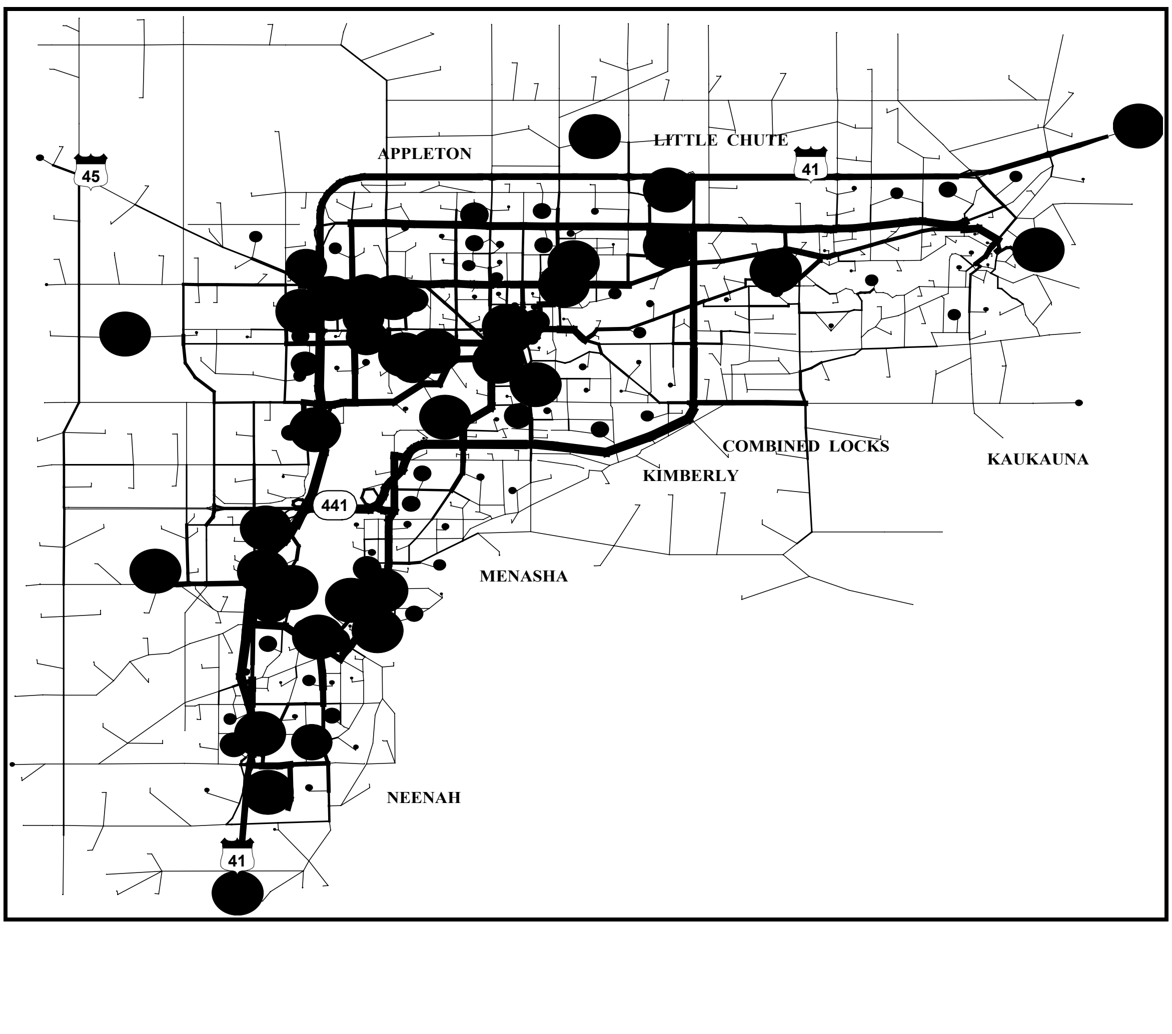
The results of the all-or-nothing traffic assignment are shown in Figure 9.5. Link widths are proportional to truck volumes, without removing streets with zero truck volumes. The sizes of centroids are roughly in proportion to their ability to attract truck trips.

As in Lawrence, the trip generation rates should be fixed for subsequent future-year forecasts.

The Fox Cities freight modeling methodology was repeated for Green Bay. However, like Lawrence, the external-to-external truck trip table for Green Bay had to be synthetically created following the procedures set out in Chapter 7. WisDOT provided the truck ADT counts for major arterials in Green Bay. The calibration procedure involved 7 runs of the model, which included adjustments to external stations as well as centroids. Calibration runs were terminated when the model overestimated the link volumes, on average, by only 1%. Because of the larger number of calibration runs, the forecasts for Green Bay are unlikely to be as strong as the forecasts from the Fox Cities.

In both the Fox Cities and Green Bay case studies the final product of a forecast is a truck trip table, not assigned volumes. The trip table would be combined with the trips for passenger vehicles before loading them to the network using equilibrium, capacity-restrained assignment methods.

Figure 9.5 Assigned Traffic Volumes in the Fox Cities Area with Size of Centroids Directly Related to Trip Attractions



9.3 Site Impact Analysis: Services Plus, Green Bay, WI

9.3.1 Introduction and Description of Case Study Site

New industries or expansion of existing ones can add additional truck traffic both to nearby streets and to outlying streets. Adapting a previously developed regionwide freight forecasting model (e.g. Site Impact Strategy 3) is one way to determine a site's potential impact. This type of analysis can provide a reasonably precise mechanism for evaluating potential truck movements and enables tailored solutions to traffic problems. Chapter 5 describes a more generic approach to site analysis. This section illustrates how a truck traffic impact assessment can be done with minimal effort.

Services Plus is anticipating adding approximately 100,000 square feet to an existing facility in Green Bay. Their site is located in an industrial park immediately off the Green Bay beltway system (see Figure 9.6). The firm specializes in the repackaging of consumer products. The site is now approximately 200,000 square feet and presently has 110 trucks entering and leaving the facility per day. All the trucks are combination units of which 40% serve the local area and 60% serve regions outside the area. Planners have estimated that the expansion will add another 55 truck trips per day to the local traffic.

Although not particularly large, this site was selected for the case study because it would demonstrate travel paths over a variety of facilities (i.e., arterials, freeways, and collectors) and a variety of destinations (external and internal), thereby indicating the features of this particular method of traffic impact analysis. In addition, the site was selected from Green Bay because a freight forecasting model for this urban area had already been prepared (see Section 9.2) and would provide yet another illustration of the value of a good freight forecasting database.[3]

9.3.2 Steps in Adapting A Model for Site Impact Analysis

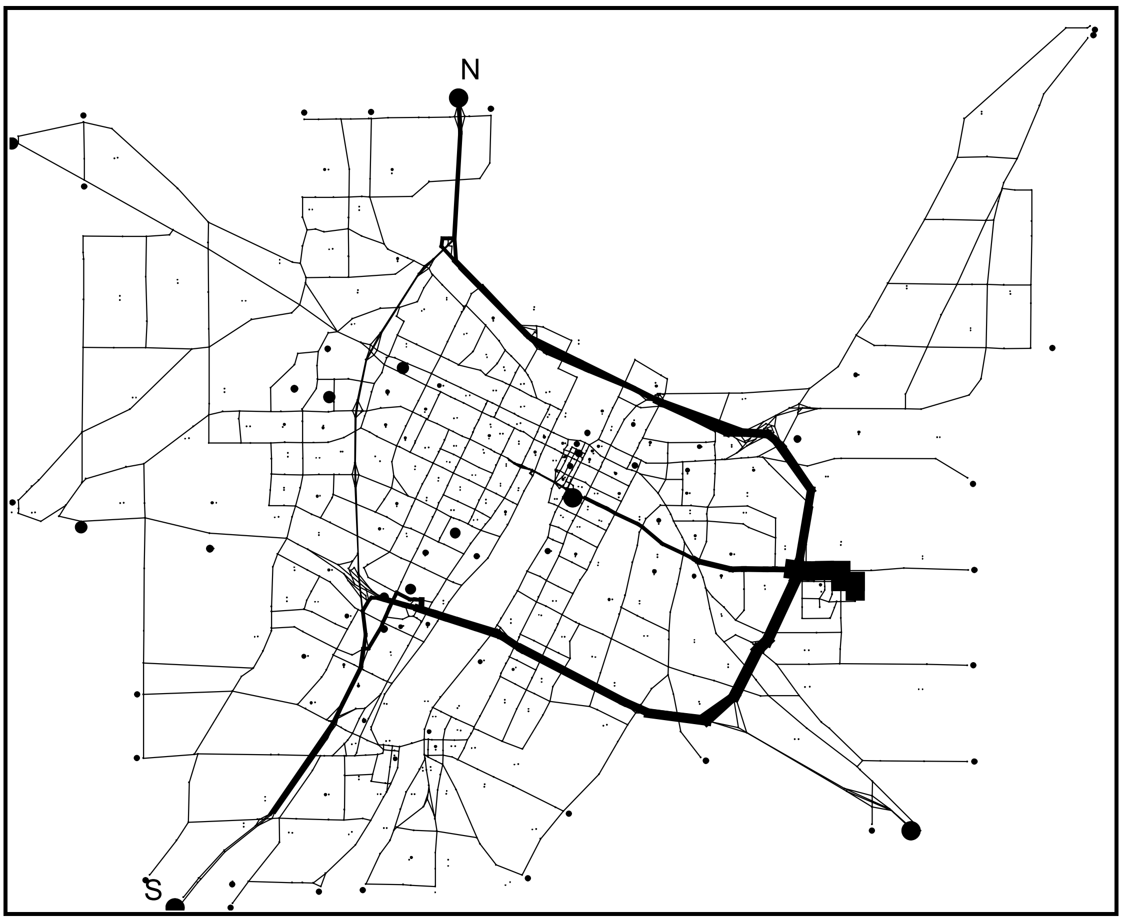
Normally a network is needed for site impact analysis (see Chapter 5, Section 5.3). The network shows the site in some detail including many of the surrounding streets. In the case of Services Plus, it was only necessary to add the streets of its industrial park to the existing regionwide network and to change some data at centroids and external stations. Had a regionwide network not been available, a subarea focused network (see Section 7.8) would have been drawn instead. A subarea focused network would have had fewer links, nodes and centroids, but it would have required the same quality of employment data. Below are the steps of the process.

Step 1 - Network Additions. The individual streets in Services Plus' industrial park were added. There were only 31 new links and 23 new nodes, including 1 new

[3] Very little effort was required to adapt the regionwide network for site impact purposes; the whole analysis (exclusive of reporting and graphics) took about 16 hours of work.

centroid. The locations of the nodes could be easily measured from a road map without resorting to digitizing. Speeds for the new links were assumed to be similar to local streets (e.g. 25 mph). One arterial link was adjusted to a slightly higher speed to better approximate preferred paths of travel. This adjustment was made after a preliminary run showing traffic diverting to a local street instead of to an arterial. This routing of traffic was related to the selection of all-or-nothing traffic assignment and the use of intersections without delays. The remainder of the links had attributes that were unchanged from the calibrated Green Bay regionwide network.

Figure 9.6 Services Plus Site (Middle Right)



Note: Figure 9.6 shows the impacts of *Services Plus* on the whole Green Bay network, with the nodes sized in proportion to trip attractions and the links sized in proportion to truck volumes from the site.

Step 2 - Setting of Productions and Attractiveness Values. The travel forecasting software needed data on productions and attractiveness values (replacing trip attractions), not origins and destinations. Eventually, the software would turn half the productions into origins and the other half into destinations. The same would be done to attractions, once they have been ascertained from the attractiveness values. A singly-constrained gravity model was selected for trip distribution, whereby only the production-end constraints will be satisfied. A singly-constrained gravity model is the same as presented in Chapter 4, except there is no attempt to match attraction totals through the iterative process. This form of the gravity model can be used to estimate the number of trip attractions at off-site zones, given a measure of attractiveness.

Two trip purposes were established: internal-to-internal and internal-to-external. To indicate only the trips generated by Services Plus, the productions and attractiveness values were modified drastically from the regionwide network. The site's centroid contained internal-to-internal trip productions and internal-to-external trip productions, based on the firm's estimates of 40% internal and 60% external shipments. The attractivness values were all placed on off-site centroids and at external stations. External stations only had attractiveness values for the internal-to-external trip purpose, while off-site centroids only received attractiveness values for the internal-to-internal trip purpose. In each case trip attractiveness values were set equal to the number of trip attractions in the regionwide model for the heavy vehicle trip purpose. For example the trip attractiveness value for the external station labeled N in Figure 9.6 was 1548 and the attractiveness value for the external station labeled S was 1361. As can be readily observed, these attractiveness values bear little relation to the number of trip ends expected from Services Plus.

Step 3 - Parameter Settings and Base-Case Run. The model was forced not to balance productions and attractions. An exponential friction factor function with a coefficient of 0.03 was used within the gravity model for trip distribution, as recommended in Section 4.4. Services Plus was unable to identify any consistent peaking characteristics in its operation, so time of day parameters were set assuming a 9-hour work day, 8 a.m. to 5 p.m. Thus, 1/9 of all trips were assumed to occur in each of those hours. Equal numbers of trips were assigned in each direction in each hour. That is, half of the trips had the site as their destination, while the other half had the site as their origin. Both full-day and single-hour analyses could be performed.

Step 4 - Assignment of Additional Trips. Knowing the existing square footage of the facility and the existing truck trips generated, a custom trip rate could be developed for this site. Had this been an entirely new site, a trip rate would have been adopted from a similar facility. There was no need to perform a new model run with increased trip productions. Since all-or-nothing assignment was used in the base case, it was only necessary to factor up the previously obtained link loadings.

Essentially, these four steps (with little modification) could be used in the evaluation of most other sites.

9.3.3 Analysis of Results

As seen in Figure 9.6, the site's traffic will be directed to the Green Bay beltway system and to a limited number of interior streets, mainly leading to industrial locations in the center of Green Bay. Although the overall impact on Green Bay's streets is small, the impact will be greatest near the entrance of the facility and on entrances to, and exits from, the freeway.

9.4 Summary

The applications in the case study cities illustrate the overall ease of adding a true freight component to an urban travel forecast. The freight forecast can piggyback on passenger vehicle forecasts by adopting, nearly intact, the passenger traffic network and by using the same employment data with little modification. However, freight-specific inputs are still required. For regionwide applications these inputs include an external-to-external trip table, truck counts on freeways and major arterials, and employment information for the largest generators. The case studies also illustrate how the need for extensive local survey data can be largely avoided by making good use of default parameters contained in this manual. The default parameters permit the creation of a solid, first-cut truck forecast that can be improved over time as more information becomes available.